CLAIMS

1. A process for the preparation of a polymer composite comprising internally distributed deposition matter wherein the process comprises

providing a deposit of deposition matter at the surface of a solid state polymer substrate by spraying or immersing solid state polymer substrate by immersing with a solution, dispersion or suspension of deposition matter for a time of the order of 1 second up to 48 hours,

drying for a time up to 48 hours by freezing, evaporation, heating or blotting whereby the deposition matter adsorbs from liquid phase on to the polymer surface and forms an adsorption layer of deposition matter which is intact to solvent and impact effects

contacting the surface deposited polymer with a plasticising fluid or a mixture of plasticising fluids under plasticising conditions to plasticise and/or swell the polymer and internally distribute deposition matter, and

releasing the plasticising fluid or fluids to obtain polymer composite.

2. A process as claimed in Claim 1 which comprises providing a deposit at the surface of a high surface area polymer substrate.

3. Process as claimed in Claim 2 wherein the polymer substrate comprises a powder bed or a high porosity matrix.

4. A process as claimed in any of Claims 1 to 3 wherein a deposit comprises a deposition layer of deposition matter on any internal and external exposed surfaces of the polymer substrate, including any exposed surface pores; over the entire surface area or only part or parts thereof.

5. A process as claimed in any of Claims 1 to 4 wherein the solid state polymer substrate is obtained by contacting polymer with plasticising fluid or a mixture of plasticising fluids under plasticising conditions to plasticise the polymer, and releasing the fluid in manner to obtain a solid state substrate polymer.

6. A process as claimed in any of Claims 1 to 4 wherein deposition matter comprises avidin tagged with rhodamine or ribonuclease and a solution of deposition matter is at concentration of 1 – 250 microgram per ml in distilled water or any liquid that dissolves the biological molecule but does not dissolve the polymer, and is pipetted onto polymer and remains in contact with polymer for a period of between 1 second and 48 hours, during which freeze-drying is used to remove the liquid.

7. A process as claimed in any of Claims 1 to 6 carried out in the absence of additional solvent capable of dissolving the deposition matter.

8. A process as claimed in any of Claims 1 to 7 wherein plasticising conditions comprise a temperature in the range –200°C to +500°C, preferably –200°C to 200°C.

9. A process as claimed in any of Claims 1 to 8 wherein plasticising conditions comprise a pressure from in excess of 1 bar to 10000 bar, preferably 1 to 1000 bar.

10. A process as claimed in any of Claims 1 to 9 wherein the process is carried out for a contact time of surface deposited polymer and plasticising fluid of 1 millisecond up to 5 hours.

11. A process as claimed in any of Claims 1 to 10 which is carried out without blending.

12. A process as claimed in any of Claims 1 to 11 wherein releasing the plasticising fluid(s) comprises prolonged gradual release of plasticising fluid giving transition to near ambient pressure conducted over a depressurisation period of in excess of 10 minutes up to 12 hours giving prolonged gradual transition for non-porous polymer, or over a period of from 1 ms to 10 minutes giving rapid transition for high porosity polymer.

13. A process as claimed in any of Claims 1 to 12 wherein plasticising fluid is selected from carbon dioxide, di-nitrogen oxide, carbon disulphide, aliphatic C_{2-10} hydrocarbons such as ethane, propane, butane, pentane, hexane, ethylene, and halogenated derivatives thereof such as for example carbon tetrafluoride or chloride and carbon monochloride trifluoride, and fluoroform or chloroform, C_{6-10} aromatics such as benzene, toluene and xylene, C_{1-3} alcohols such as methanol and ethanol, sulphur halides such as sulphur hexafluoride, ammonia, xenon, krypton, and mixtures thereof.

14. A process as claimed in any of Claims 1 to 13 wherein deposition matter is present in an amount with respect to polymer of $1x10^{-12}$ wt% to 99.9 wt%.

15. A process as claimed in Claim 14 wherein deposition matter is present, presented as concentration of deposition matter on polymer, in low volumes in the range $1x10^{1}$ to $1x10^{3}$ ng/mg.

16. Process as claimed in any of Claims 1 to 15, wherein the polymer composite comprises a porous or non porous polymer throughout which

particulate deposition matter is distributed with uniformity in excess of 98%, and comprising levels of deposition matter, presented as concentration of deposition matter on polymer, in the range $1x10^1$ to $1x10^3$ ng/mg.

17. Process as claimed in any of Claims 1 to 16 wherein the polymer composite comprises a porous or non porous polymer throughout which particulate deposition matter is distributed with uniformity in excess of 98%, and comprising deposition matter particle size of the order of 10 microns, 1 micron or 0.1 microns.

18. A process as claimed in any of Claims 1 to 17 wherein deposition material is selected from (pharmaceutical) drugs and veterinary products; agrochemicals as pest and plant growth control agents; human and animal health products; human and animal growth promoting, structural, or cosmetic products including products intended for growth or repair or modelling of the skeleton, organs, dental structure; absorbent biodeposition materials for poisons, toxins.

19. A process as claimed in any of Claims 1 to 18 wherein deposition matter alternatively or additionally comprises function enhancing components, including naturally occurring or synthetic or otherwise modified growth promoters, biocompatibilisers, vitamins, proteins, glycoproteins, enzymes, nucleic acid, carbohydrates, minerals, nutrients, steroids, ceramics and the like and functioning matter such as spores, viruses, mammalian, plant and bacterial cells.

20. Process as claimed in any of Claims 1 to 19 wherein polymer is selected from: polyesters including poly(lactic acid), poly(glycolic acid), copolymers of lactic and glycolic acid, copolymers of lactic and glycolic acid with poly(ethylene glycol), poly(e-caprolactone), poly(3-hydroxybutyrate),

poly(p-dioxanone), poly(propylene fumarate); poly (ortho esters); polyanhydrides; Poly(amino acids); polyacetals; polyketals; polyorthoesters; Polyphosphazenes; azo polymers; synthetic Non-biodegradable Polymers selected from: Vinyl polymers including polyethylene, poly(ethylene-co-vinyl acetate), polypropylene, poly(vinyl chloride), poly(vinyl acetate), poly(vinyl alcohol) and copolymers of vinyl alcohol and vinyl acetate, poly(acrylic acid) poly(methacrylic acid), polyacrylamides, polymethacrylamides, polyacrylates, Poly(ethylene glycol), Poly(dimethyl siloxane), Polyurethanes, Polycarbonates, Polystyrene and derivatives; and Natural Polymers selected from carbohydrates, polypeptides and proteins.

21. A polymer composite when obtained by the process of any of Claims 1 to 20.

22. A scaffold comprising a polymer composite having internally distributed deposition matter obtained by the process of any of Claims 1 to 20 suitably sized and shaped for a desired application.

23. The use of a polymer composite or a scaffold thereof prepared by the process of any of Claims 1 to 20, for drug delivery, in bioremediation, as a biocatalyst or biobarrier for human or animal or plant matter, as a structural component comprising the polymer and optional additional synthetic or natural metal, plastic, carbon or glass fibre mesh, scrim, rod or like reinforcing for medical or surgical insertion, for insertion as a solid monolith into bone or tissue, as fillers or cements for wet insertion into bone or teeth or as solid aggregates or monoliths for orthopaedic implants such as pins, or dental implants such as crowns.

24. A process for preparing a polymer composite, a polymer composite, a scaffold, or the use thereof substantially as described in the description or illustrated in the Examples.